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A NEW FAMILY OF MILLIPEDS OF THE ORDER  
SPIROBOLIDA, WITH NOTES ON AN  
ESTABLISHED FAMILY

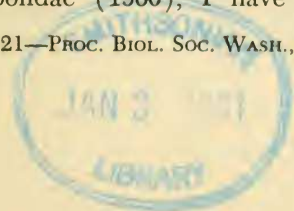
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The milliped order Spirobolida is a well-defined taxonomic group with representatives in all of the zoogeographic regions of the world. Many genera (152 according to Hoffman and Keeton, 1960) and hundreds of species have been described during the past 150 years. Yet, in few groups of animals has there been less serious effort to establish a satisfactory classification at the family level of the taxonomic hierarchy. At the time of their original description, many genera have simply been allocated to the order, with no mention of family position.

One important paper by Brölemann (1914) is an outstanding exception to the general lack of attention to the classification of the Spirobolida. Brölemann's work established a basis on which later research could have built a sound taxonomic system. But this basis has been largely ignored, and most workers have continued to place all new genera in "convenient" and widely known families such as Spirobolidae, Rhinocricidae, or Trigonulidae, or not to place them in any family. Thus such validly described Brölemann families as Spirobolellidae (to which several "spirobolid" genera such as *Microspirobolus*, *Aporobolus*, *Spirobolinus*, and their relatives apparently belong) and Pseudospirobolellidae (to which such genera as *Guamobolus*, *Javobolus*, *Saipanella*, *Azygobolus*, etc. obviously belong) have all but disappeared from the literature.

Having become interested in the taxonomy of the Spirobolida while preparing a comprehensive revision of the family Spirobolidae (1960), I have begun a long-term study of



the order, with the goal of eventually providing for it an adequate and meaningful classification. In the course of this study, it has become evident not only that many genera must be moved from their existing positions to other families, but also that several new families are needed to accommodate genera which cannot any longer be left in the families into which they customarily have been shoved. I have (1959) proposed one such new family, and here propose another for two "orphan" genera.

#### ALLOPOCOCKIIDAE, New Family

*Diagnosis:* A family of the Spirobolidea as indicated by the structure of the phallopods, which do not possess the well-developed seminal bladders typical of the Trigoniulidea. Phallopods independent; telopodite, coxa, and coxal apodeme arranged in the essentially linear manner often seen in Spirobolidea. Distinguished from all other families of the Spirobolidea except Spirobolidae and Floridobolidae by the presence of well-developed coxae of the phallopods. Differs from these two families in having large apodemes of the coxal endites of the coleopods. Lacks the prominent basal sclerite present in Floridobolidae. Sternum of coleopods narrow, thus differing from the large sternum typical of Rhinocricidae and Spirobolellidae, but in its presence differing from the condition of Pseudospirobolellidae where the sternum is almost or completely absent.

*Included genera:* *Allopocockia* Brölemann, 1913, and *Chelogonobolus* Carl, 1919.

*Discussion:* The genus *Allopocockia* was first described by Brölemann (1913: 478; 1914: 34) for *Spirobolellus tylopus* Pocock, 1908, from Guatemala. Brölemann's knowledge of this species was limited to Pocock's published description, which included four drawings. Although this description was far superior to most being published during Pocock's time, it gave no information regarding the critical characters of the basal portions of the gonopods. As a result, Brölemann had to rely on his own best guess as to which family *Allopocockia* represented. He placed the genus in the Trigoniulidae, but indicated his uncertainty by putting a question mark before the name.

Five years later Carl (1919) reported the results of his examination of the type specimens of *Spirobolus nahuus* Saussure and Humbert. He found that this Mexican species closely resembled *Allopocockia tylopus*, but differed from it in lacking the striking modifications of the pregenital legs of males and in not having pronounced mesial ventral productions of the coxal endites of the coleopods. Carl made *nahuus* the type of a new genus, *Chelogonobolus*, and redescribed the species at the same time. In his usual thorough fashion, Carl carefully studied the basic characters of *nahuus* and made known for the first time the details of the more internal portions of the gonopods—the characters that had been unknown

to Brölemann in the case of *tylopus*. These characters made it necessary, as Carl remarked, to remove *Allopocockia* from the Trigoniulidae and to assign it and *Chelogonobolus* to some other family. Carl recognized the unusual characteristics of these two genera saying, "Ce qui est certain, c'est qu'ils occupent dans le système actuel une position tout à fait isolée et ne rentrent dans aucune des familles établies par Brölemann." In spite of this, however, having removed the genera from the Trigoniulidae, his natural conservative nature led Carl neither to establish a new family for them nor to place them in any other existing family. It now seems time to rescue these genera from the no-man's land in which they have lain neglected, and to describe for them the new family which they so obviously deserve.

I have chosen to base the new family name on the older of the two included genera in view of the possibility that future studies may necessitate regarding the two as congeneric.

My own first-hand knowledge of the group is limited to the type specimens of *Chelogonobolus nahuus*, which were lent to me for study by Hermann Gisin of The Muséum d' Histoire Naturelle, Genève, Switzerland, to whom my sincere thanks are extended. I shall here contribute no new information regarding the other species of the Allopocockiidae, but shall give more detailed treatment to *nahuus*.

#### Genus *Allopocockia* Brölemann

*Allopocockia* Brölemann, 1913, Bull. Soc. ent. France, p. 478. Type: *Spirobolellus tylopus* Pocock, by original designation.

*Allopocockia* Brölemann, 1914, Ann. Soc. ent. France, 83: 34.

**Diagnosis:** Distinguished from *Chelogonobolus* by the presence of a "distinct papilla" or bladder-like structure on the protarsus of the third leg of males; by having the last segment of the third to seventh legs of males "inflated," and the claws of these legs reduced to minute vestigial structures; and by having the mesial ventral corners of the coxal endites of the male coleopods produced ventrad.

**Discussion:** In some other spiroboloid groups striking modifications of male pregenital legs frequently occur and have often been found to warrant only specific recognition. Generic level differences in these characters are generally accompanied by gonopodal differences more elaborate than those known to exist between *Allopocockia* and *Chelogonobolus*. In the absence of study specimens of *Allopocockia*, however, and in our present meagre state of knowledge of this small but very distinct family, I do not feel it advisable at present to regard the two genera as synonymous.

**Included species:** Only *A. tylopus* (Pocock), from Tecpam, Guatemala.

#### Genus *Chelogonobolus* Carl

*Chelogonobolus* Carl, 1919, Rev. Suisse Zool., 27: 399. Type: *Spirobolus nahuus* Saussure and Humbert, by original designation.

*Diagnosis:* Distinguished from *Allopocockia* by the characters of the male pregenital legs and gonopods mentioned above.

*Chelogonobolus nahuus* (Saussure and Humbert)

(Figs. 1-7)

*Spirobolus nahuus* Saussure and Humbert, 1869, Rev. Mag. Zool., ser. 2, 21: 154.

*Spirobolus nahuus* Saussure and Humbert, 1872, Mission scientifique Mexique, Myriapodes, p. 86.

*Spirobolellus nahuus*, Pocock, 1908, Biol. Centr.-Amer., Chilopoda and Diplopoda, p. 88.

*Chelogonobolus nahuus*, Carl, 1919, Rev. Suisse Zool., 27: 401, Figs. 32-39.

*Description and discussion:* I shall not attempt to give a full redescription of this species inasmuch as Carl's treatment is an excellent one. My concern here is only in adding some details not fully covered in previous publications. My discussion is based on an examination of the type material belonging to the Geneva Museum. This material, all in a single vial, consists of: one anterior portion of head + 21 segments, with male gonopods *in situ*; two mid-body sections of 5 and 7 segments; three posterior portions of 14, 15, and 16 segments respectively, each with complete anal areas; and a separate set of male gonopods.

The original description gives segment counts of 35 for a female, and 32 and 35 for males. These are small millipeds compared to many spiroboloids, being 16-23 mm long according to the literature, and averaging about 1.7 mm in width according to my measurements.

Clypeus broad, its margins very rounded, there being no distinct ventral corners. Lateral corners of clypeus not very distinct, sloping rather gradually into moderately shallow antennal grooves. Parietal sclerites unmodified. Mandibular cheeks not appreciably grooved for reception of antennae; ventrodistal corners of stipites of mandibles abruptly angular, the stipites being thus rather square distally but with distal margins very slightly concave. Eye patches subcircular, the eyes not arranged in distinct rows; about 17-20 eyes per patch. Labrum small, with 3 indistinct teeth assymmetrically arranged. Clypeal setae 3 + 3; labral setae 5 + 3 (both counts based on only one specimen). Antennae very short and stout; second segment slightly longer than the others, slightly surpassing lateral margins of clypeus; few small scattered setae on first 4 antennal articles, more distal articles densely hirsute; 4 antennal sensory cones. Gnathochilarium (Fig. 1) of the usual general spiroboloid construction, including an undivided prebasilare, but mentum (M) somewhat distinctive in having distinctly swollen lateral areas at bases of stipites (S), these convex areas (ca) being partially set-off by indistinct grooves (apparently not sutures); stipital setae 3 + 3.

Collum not unusually large, covering only vertex of head, subtruncate laterally, the anterior corners much more pronounced than the posterior



corners; anterior margining ridges present but not pronounced. Second segment not produced ventrolaterally, bending abruptly mesad at level of lateral ends of collum.

Tergites smooth, without rugulae but with a few scattered puncta; striae on extreme ventral portions only. Segmental suture extremely indistinct, not marked by any external groove, visible only as an obscure light line in cleared specimens. Repugnatorial pores located more posteriorly than in Spirobolidae, their exact location relative to the segmental suture being difficult to determine because of the obscure nature of the latter; apparently about a third of peritreme area of each pore is anterior to the line of the suture, and about two-thirds of peritreme area is posterior to this line. I was unable to detect the suture itself in the immediate vicinity of the pore, and thus cannot say whether it curves around the pore anteriorly or posteriorly.

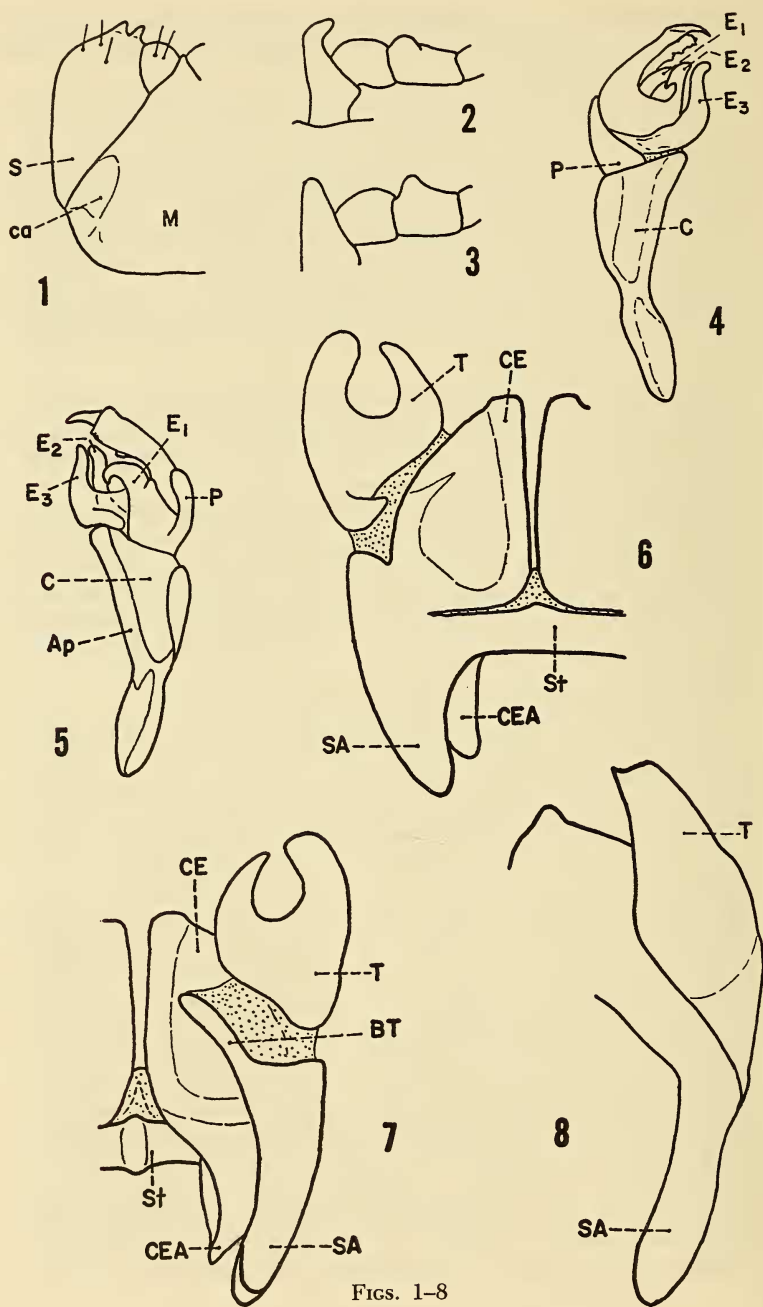
Entire tergum of telson broadly triangular, its obtuse apex just reaching posterior border of anal valves, which are thus not visible from dorsal view. Valves with smoothly convex surfaces, these meeting evenly with no trace of anal lips and no reentrant angle.

Coxae of third legs of males (Fig. 2) much produced ventrad; distal portions of lobes thus formed bent laterad. Coxae of fourth (Fig. 3) and fifth legs of males also produced ventrad forming lobes with narrowly rounded apices, but these not bent laterad. Coxae of sixth legs only slightly produced; those of seventh legs not produced. All legs with very few ventral setae and no ventral pads. Claws  $\frac{1}{3}$ – $\frac{1}{2}$  the length of the last podomeres.

Postgenital bar forming a large ridge behind gonopod socket.

The gonopods, so important in classification, have been well described and figured by Carl. I shall mention only a few details here. As shown in Figures 6 and 7, the coxal endites of the coleopods are not uniformly sclerotized; a heavily sclerotized region runs along the mesial border of each endite, curves laterad along the base of the endite, then ventrad along the ventrolateral border, and ends at about the midpoint of this border. The portion of the endite enclosed by this heavier area is very thin, almost membranous. The sternum (S) is narrow, but the sternal apodemes (SA) are broad and each curves around onto the caudal face of the coleopod, thus enclosing a large mesial concavity. The "bride trachéenne" (BT), as Brölemann (1914) calls it, is very well developed and is attached by a membrane directly to the telopodite, there being between them no well-defined posterior coxal bar ("fémoroids" of Brölemann) such as is seen in most families. The telopodites (T; shown in the figures pulled ventrolaterad from the normal position) are not closely united to the rest of the coleopod structure, but are connected to it only by membranes. The prominent condyle on the cephalolateral corner is shown in Figure 6, as is the unusual shape of the telopodite. Figure 7 shows the very stout, mesially concave apodeme of the coxal endite (CEA).

Figures 4 and 5 show the phallopods, the details of which are more



FIGS. 1-8

easily understood from the drawings than from lengthly verbal descriptions. I shall here only call attention to the large expanded coxal piece (C) fused with the more strongly sclerotized apodemal ridges (Ap); to the three separate endites of the telopodite ( $E_1$ ,  $E_2$ ,  $E_3$ ); and to the separate and strongly sclerotized plate (P) on the outer surface of the base of the telopodite. Insofar as Pocock (1908, Tab. 7, Fig. 8c) has shown the details of the phallopods of *Allopocockia tylopus* (Pocock), they seem to correspond closely with those here shown for *Chelogonobolus nahuus*, even to the shape of the distal portion of the second endite ( $E_2$ ). It is this close similarity that prompts me to question the validity of the separate genera proposed for these two species.

I have seen no female cyphopods of *C. nahuus*, but would predict that the cephalic and caudal plates will be found to be fused along a lateral suture, as seems to be typical in the Spirobolidea.

*Chelogonobolus atriculus* (Pocock), new combination

*Spirobolellus atriculus* Pocock, 1908, Biol. Centr.-Amer., Chilopoda and Diplopoda, p. 88, tab. 7, Figs. 9a-c.

*Discussion:* Pocock's description and drawings establish the fact that this form does not exhibit the characters of the male pregenital legs and coleopods which distinguish *Allopocockia*. It seems to resemble closely *C. nahuus* and to belong in *Chelogonobolus*. I can say nothing regarding the possible conspecificity of this Guatemalan species with the Mexican *C. nahuus*.

#### FLORIDOBOLIDAE

*Floridobolus penneri* Causey

(Fig. 8)

*Floridobolus penneri* Causey, 1957, Proc. Biol. Soc. Washington, 70: 206, Figs. 1-3.

*Floridobolus penneri*, Keeton, 1959, Bull. Brooklyn Ent. Soc., 54: 2, Figs. 1-12, 14-16.

*Discussion:* Both previous published accounts of this species were based on relatively few specimens. Recently, however, Thomas Eisner, of Cornell University, and his assistants Roger S. Payne, Benjamin Dane, and Ralph L. Ghent spent a week at the type locality, Archibold Biological Station, Lake Placid, Highlands County, Florida. There they collected a large series of *F. penneri* for use in physiological and behavioral studies in their laboratory at Cornell. They have given me 25 adult specimens (24 male, 1 female) from their series, and I wish to express my appreciation to them. These specimens make it possible to give more accurate information regarding several characters of this species.

The number of segments shows less variation than is commonly encountered in spiroboloid millipeds, the count varying from 47 to 51 but most specimens having 48 (16 of 25 specimens) or 49 (5 of 25 specimens), with an average of 48.3. Lengths of adults examined range from

60 mm to 92 mm (average 74.2 mm); widths from 10.0 mm to 12.8 mm (average 11.6 mm). The L/W ratios of adults over 70 mm long vary from 6.3 to 7.4, averaging 6.7; the same ratios for adults 60–69 mm long vary from 5.6 to 6.4, averaging 5.9; the average for all adults examined, regardless of size, is 6.4.

The total number (both sides combined) of clypeal foveae ranges from 5 in one specimen to 11 in two specimens, but most individuals have 8–10, with an average of 9.1. In addition to the usual 4 or 5 such foveae on each side of the clypeus, most specimens have on each side an additional fovea-like depression or cleft located on the prominent ventral corner of the clypeus; these do not bear setae and are not included in the counts given above. The total of labral setae varies from 13 to 24, with an average of 17.5.

The number of eyes per patch is usually greater than in most spirobolids, ranging from 52–66 with an average of about 60.

The convexity of the apex of the mentum of the gnathochilarium has been found to be constant and is thus a trustworthy key character. The structure of the gnathochilarium is in other respects of the typical spiroboloid pattern. It should be mentioned here that well-formed cardines are present in this genus as well as in other members of the order Spirobolida, in spite of Attem's statement (1926: 192) to the contrary (mentioned by Hoffman and Orcutt, 1960: 101). These small sclerites often cannot be seen on the outer face of the gnathochilarium as each is covered by a membrane located in the area between the base of the stipes and the basal corner of the mentum. If the entire mouthpart is removed from the head and viewed from the inner surface, the cardines are readily seen. As seems to be true of all spiroboloid species, each lingual lamella bears two prominent setae. The number of macrosetae on the distal portion of each stipes varies from 6 to 11, with the total number averaging 16.3.

The knob-like productions on the distal portions of the ventral surfaces of the second podomeres of the walking legs apparently vary greatly, and they are often small and much less noticeable than I previously (1959, Fig. 4) indicated.

My earlier interpretation of the structure of the male gonopods needs some revision in light of recent findings using cleared specimens. I indicated (1959: 6 and Figs. 10–12) that there was only one posterior structure of the coleopod, and considered this to be the posterior coxal bar, a telopodite not being present. In cleared specimens, however, a faint sutural line can be seen as indicated here in Figure 8. Apparently, then, the telopodite and posterior coxal bar have become fused together, the former thus being no longer movable. This condition is unique in the order so far as I know. Variation in the details of the distal portions of the phallopods seems to be very slight, although the expanded portion of the distolateral coxal surface shows much variation in extent. The basal sclerite is always present and is easily seen in cleared specimens.

Eisner reports several interesting observations on the habits of this



species in the wild. Specimens were abundant between 9 and 14 September 1959, under dead logs on sand. They were not common under logs that were buried more deeply in the sand. The species could only be found in areas where there were stands of woody plants, thus differing from *Narceus gordanus* (Chamberlin) which was common in open sandy places where there were few such woody plants. The collectors are sure that *F. penneri* never burrowed deep into the sand in the manner typical of *N. gordanus*, the latter species making characteristic round tunnels, the mouths of which dotted sandy areas. *F. penneri* was often seen feeding on the fruiting bodies of the palmetto plants. Eisner notes that the species was far more common in September, 1959, than in late June, 1958, being as common as *N. gordanus* in September but much less common than that species in June.

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## EXPLANATION OF FIGURES

Figs. 1-7, *Chelogonobolus nahuus* (Saussure and Humbert). Fig. 1.—gnathochilarium, right half. Fig. 2.—basal portion of right third leg, cephalic view. Fig. 3.—basal portion of right fourth leg, cephalic view. Fig. 4.—left phallopod, cephalic view. Fig. 5.—left phallopod, caudal view. Fig. 6.—left coleopod, cephalic view. Fig. 7.—left coleopod, caudal view (in both Figs. 6 and 7 the telopodite has been pulled out of

normal position). Fig. 8.—*Floridobolus penneri* Causey, portion of left coleopod, caudal view, showing indistinct sutural line between telopodite and posterior coxal bar. Abbreviations: Ap—apodemal ridges, BT—bride trachéene, C—coxal piece, ca—convex area of mentum of gnathochilarium, CE—coxal endite, CEA—apodeme of coxal endite, E<sub>1</sub>, E<sub>2</sub>, E<sub>3</sub>—endites of the telopodite, M—mentum, P—scleratized plate, S—stipes, SA—sternal apodeme, St—sternum, T—telopodite.